to shirk effort altogether by accepting phrases which cloak the unknown in the undefinable.'' Others again may object to the particular make-up of this 'Grammar'; may question whether the long discussion of the quantitative aspects of evolution (a novel feature of the second edition) however interesting in itself, finds a co-ordinate place with the rest of the chapters, or whether it represents unduly the special trend of the writer's interests. But no critic can fail to find the general treatment rigorous and suggestive, and to feel that the possibilities of presenting the fundamental conceptions of science to the student have been appreciably increased by Professor Pearson's labors in his behalf. JOSEPH JASTROW.

The Microscopy of Drinking Water. By GEORGE CHANDLER WHIPPLE. New York, John Wiley & Sons. 1899. Pp. xii + 300. With 21 figures and 19 half-tone plates.

The biological examination of potable water has been conducted upon an extensive scale in this country for more than a decade, especially in Massachusetts where the State Board of Health and the City of Boston have maintained laboratories for the scientific investigation of water supplies. It is fitting, therefore, that the first extensive hand-book upon the subject of the microscopy of drinking water should have been written by one long associated with this work.

Mr. Whipple's 'Microscopy of Drinking Water,' is more, however, than a mere manual, for it presents the generalization derived from the explorations and statistical data accumulated by the State Board of Health, the Boston, and more recently the Brooklyn Water Works for a series of years. It thus treats of many problems of limnology and fresh water biology of interest not only to the sanitary engineer and water expert but to the biologist and physicist as well.

The opening chapter is devoted to a historical treatment of the subject in which the faunistic and systematic biology of fresh water, and planktology also, are included. The treatment is brief and there are many omissions. There is, for example, no mention of recent investigations of water supplies in European cities, nor is any reference made to the lacustrine explorations of the United States Fish Commission in past years. The excellent work of the Bohemian Survey and of the Balaton Lake Commission in Hungary is unnoticed. Hensen, the father of planktology, is referred to as having devised a 'new method of studying the minute floating organisms found in *lakes!*' The planktonocrit is ascribed to Dolley, and the Plankton pump to Ward and Fordyce. The first use of the centrifuge in plankton work seems to have been made by Krämer or Cori, and the pump for the collection of plankton was used by Henson, by Peck, at the Illinois Biological Station, and by Frenzel, before the pump named was described.

Bacterial examination is not treated in the work as its methods are different and involve other processes than microscopical examination. The purpose and relative values of the various forms of sanitary examination are discussed at length by the author. The physical, biological and chemical analysis of water supplies are each important, and are mutually supplementary. The interpretation of an analysis is a matter of expert skill quite as much as the making of the analysis. ''In the detection of pollution the chemical and bacteriological examinations furnish the most information, in the study of the æsthetic qualities of a water the physical and microscopical examinations are most important, while in investigations concerning the value of a water for industrial purposes the physical and chemical examinations sometimes suffice.'' The purposes of microscopical examination are stated to be the detection of sewage pollution, the explanation of turbidity, of taste and of odor of water, the interpretation of chemical analysis, and the study of food of fishes and other aquatic animals. The most important service which the microscopical examination of potable water renders is thus in the study of its æsthetic qualities.

The Sedgwick-Rafter method of water examination is described with its various modifications and improvements, and the errors incident to its use are discussed. The error from leakage through the sand may rise as high as 25 per cent. or even 50 per cent. when minute organisms are present in large numbers, and the statement is made that most of the escaping organisms pass through the sand in the

earlier part of the filtration. In the reviewer's hands this method has yielded even larger errors with water heavily charged with minute flagellates and other motile organisms, when checked by more precise methods of filtration. The greatest escape of organisms occurred, not at the beginning, but toward the close of the period of filtration. The author concludes that the method is precise within 10 per cent., *i. e.*, two examinations of the same sample seldom differ by more than that amount.

A few pages are devoted to a brief discussion of the plankton method in which the Reighard and Birge nets are described though the more generally used Apstein model is not mentioned. The author objects to the standard unit of volume, a cubic meter, adopted by planktologists on the ground that it necessitates the use of large numbers in the case of minute organisms. In plankton work a uniform unit is a necessity and the small unit of the Sedgwick-Rafter method, which he suggests, is equally objectionable, as it would frequently necessitate the employment of fractions or decimals, and could not be readily correlated with most available and generally accepted unit for quantitative work, viz, the cubic meter. The statement that 'many delicate organisms are crushed upon the net' in the collection of plankton and that the pumping method conduces to imperfect filtration are not borne out by the practical experience of the reviewer.

The comparative absence of organisms in rain and ground waters and in filter-galleries is noted, and their relative abundance in surface waters is discussed. The general statement is made that standing water contains more organisms than running water. "Samples from rivers, unless collected near shore, seldom contain many organisms. Organisms found in streams are largely sedentary forms. Their food-supply is brought to them by the water continually passing. In quiet waters there are found free-swimming forms that must go in search of their food." It is undoubtedly true that there is but little plankton in the small and rapidly flowing streams of New England and in like waters elsewhere; but in larger streams there is a true plankton, often abundant, and very largely made up of typical plankton organisms, as has been shown by investigations of the Elbe, the Oder, the Danube, the Nile, the Illinois and the Mississippi Rivers. The current probably bears some inverse ratio to the number of organisms present in a stream, but the fact of its presence does not necessarily preclude the development of an abundant and typical plankton in river waters, provided *time for breeding is afforded.*

Interesting data concerning the physics of lakes and reservoirs, especially in regard to the seasonal overturning of the water and summer stagnation below the thermocline, are to be found in the chapter on limnology. The organisms which occur in water-supplies are listed with reference to the frequency of their occurrence and their obnoxious qualities. In all 186 genera are catalogued of which but 18 are common, and of these at least 10 are troublesome because of their unpleasant effects upon potable waters. The relative frequency of different organisms and the relation of their occurrences to the depth of the pond, to the nature of the bottom, to the color of the water, and to the chemical analysis are discussed in the light of statistics accumulated in the biological examinations of Massachusetts waters. The same data afford a basis for a treatment of the seasonal, horizontal and vertical distribution of organisms in pond and reservoir waters. Technical matters such as the odors of water-supplies, the storage of ground, and of surface-waters, and the growth of organisms in water-pipes receive expert attention.

A considerable part of the work is given up to a descriptive list of the genera of microscopic organisms which will be of great assistance to the amateur or the beginner. Nineteen well-executed half-tone plates will further assist in the identification of the more common organisms. We note the omission of *Pleodorina*, which occasionally becomes a water-pest; that *Spirodela* is figured as *Lemna;* and that *Diaptomus* appears on the plate with the ovisac *dorsal* to the abdomen.

The bibliography at the close of the book seems to be very full in the technical phases of the subject of water supplies. On the biological side it is less satisfactory, the titles by no means representing the best or the latest literature of the subject, a defect easily remedied in a later edition.

The work of Mr. Whipple is an invaluable guide for the microscopical examination of potable water, in comprehensiveness and execution far surpassing all previous manuals of the subject in the English language, or for that matter in any other. It is also of great interest to the biologist, since it summarizes from literature not ordinarily gleaned the contributions of many workers on varions problems of freshwater ecology. It is to be hoped that this book will serve as a stimulus to all engaged in this field of applied biology to contribute to the solution of the many unsolved problems which their facilities and opportunities peculiarly fit them to attack.

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Analyse Chimique Qualitative. Par M.-E. POZZI-ESCOT. Paris, Gauthier-Villars.

This little book is instructive and valuable, as the author, instead of following the beaten track of qualitative separations, adopts mainly the methods of M. Ad. Carnot, and of Engel and Silva for metalloids. He gives especial attention to the detection of the rarer elements, utilizing methods of Cleve, of Wyronboff and Verneuil, and others.

Some of the methods of Carnot are rapid and give elegant results; the method of separating cobalt, nickel, iron, zinc, manganese, thallium, indium, and uranium, utilizing hydrogen peroxide may be particularly commended.

EDWARD RENOUF.

DISCUSSION AND CORRESPONDENCE.

DEFORMED STERNA IN THE DOMESTICATED FOWL.

THE fact that the keel of the sternum is frequently crooked in the domestic fowl has long been known to me, but until the publication of several papers either discussing the cause of this deformation, or bringing it forward as an instance of the inheritance of an acquired character, the reason for it had seemed quite evident. Now it may be that this is one of the cases where a thing is not so simple as it appears to be on the surface, but the primary cause for this curvature of the sternal keel has always seemed to me enforced flightlessness and consequent failure of the pectoral muscles to pull the sternum straight, while this may be aggravated by the feeding of corn which forms flesh, but not bone. Another factor would seem to be the effort to breed fowls that shall be heavy in flesh, attempting to increase the size of the pectoral muscles at the very time the sternum is diminishing in size from the disuse of these same muscles. Thus while the sternum as a whole is degenerating a larger keel is needed for the attachment of muscles and under these conditions the only way to obtain more surface is by the curvature of the keel. It has been remarked that thoroughbred fowls are more liable than others to have deformed sternal keels and these it may be noted are the very birds that get the least amount of exercise. The games, and other breeds not raised for flesh usually have straight sterna while the heavy-bodied Asiatics are particularly liable to have crooked sterna and it may be said that the same deformation often occurs among fancy pigeons bred for show and deprived of exercise by being cooped up in lofts.

That a deformation inconstant in direction and far from universal should not be regularly inherited is not surprising; that it is due to resting the breast on the perch, although this may be one of various causes, is doubtful; that cases where the deformation seems to be passed from mother to chick should be regarded as instances of the inheritance of an acquired character is even more to be doubted.

Finally it may be said that this twisting of the sternal keel is much greater in a dried sternum than in one that is fresh or has been soaked over night in water. Among the sterna of Great Auk collected in 1887 not one was straight, although they could be made straight by soaking and it is a difficult matter to find a straight keel on the dried sternum of a Murre or Razorbill.

F. A. LUCAS.

REMARKS ON THE LOESS IN NORTH CHINA.

ALTHOUGH there has been considerable discussion regarding the loess of North China, there are some facts which have not been presented with sufficient prominence, although mentioned by Pumpelly and others. In a trip of 450 miles